

Applicant : Peter de Groot et al.
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REMARKS

Preliminarily, we note that the Examiner's action did not include an initialed copy of the Form PTO-1449 from our Supplemental Information Disclosure Statement filed April 8, 2003. We enclose a copy of that Form PTO-1449 with this reply and ask the Examiner to initial it and return it to us with his next communication. Furthermore, we note that a second Supplemental Information Disclosure Statement is being filed together with this reply.

Based on the claim amendments above, claims 1-16, 21-39, 42-60, 62-64, 66-71, and 73-80 are pending. Claims 1, 25, 42, 44, 48, 57, 64, 66, 67, 73, 76, and 79 are the independent claims.

We acknowledge the Examiner's indication that claims 57 and 64 would be allowable if rewritten in independent form. Accordingly, we have amended claims 57 and 64 to be in independent form.

We also acknowledge the Examiner's indication with reference to claim 49 that "the prior art made of record does not disclose or reasonably teach the arrangement of directing a beam in a third direction for interferometric measurement of a test object." Accordingly, we have amended claim 48 to recite that "the optical profiler is configured to direct a first portion of EM radiation from a source towards the first viewing port, direct a second portion of the EM radiation towards the second viewing port, and direct at least one additional portion of the EM radiation within the optical profiler." We submit that the Examiner's rationale for indicating that claim 49 is allowable is applicable to claim 48 as presently amended and we therefore ask the Examiner to allow the claim. Claim 49 continues to be a dependent claim, but now depends from claim 48.

We now turn to independent claims 1, 25, 42, 66, 67, and 73. Claims 1 and 42 were amended to include the features of previously pending claims 20 and 65, respectively. Claims 25 and 66 have been rewritten in independent form (although claim 25 as presently amended does not include all of the features of previously intervening claims). Claims 67 and 73 are unchanged. All of these claims stand rejected as obvious over Kulaweic (U.S. Patent No. 5,793,488), or Kulaweic further in view of Mackinouchi (U.S. Patent No. 5,969,800).

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First, with respect to independent claims 1, 42, and 67, we submit that Kulaweic, either by itself or together with Mackinouchi, fails to teach or suggest: "determining a spatial relationship between the first and second datum surfaces based on at least one interferometric displacement measurement," as recited in claim 1; "a displacement measuring interferometer positioned to measure the spatial relationship between the first and second datum surfaces," as recited in claim 42; or "a displacement measuring interferometer positioned to measure a change in a relative position of the first and second datum surface caused by an adjustment to the at least one movable stage," as recited in claim 67.

In rejecting such claims the Examiner points to col. 4, lines 53-59 of Kulaweic as teaching "a movable stage that is advantageously moved such that measurements can be made at several different positions in order to remove systematic errors. Each of these positions is a datum level for each set of measurements of multiple points on each surface" (page 6 of action). We do not understand the Examiner's position here. As best as we can tell, the Examiner points to the movement of test piece 12 by air bearing 16 as providing the claimed first and second datum surfaces for the respective first and second surfaces of the test object. We disagree that such features are disclosed by the cited section of Kulawiec.

To the contrary, with reference to FIGS. 1-5, Kulawiec is interferometrically profiling a single surface - the inner surface of a cylindrical test piece 12 (see FIG. 2). Moreover, the profiling is done with respect to only one datum surface, one whose position is unchanged by any movement of the test object by air bearing 16. In particular, referring to FIGS. 2 and 3, test wavefront 32 reflects from the outer surface of the test piece and interferes with reference wavefront 34 to form an interference pattern 44 as shown in FIG. 3 (see col. 5, lines 20-25). Kulawiec explains that "[t]he imaged interference pattern 44, which is superimposed on the test surface 14, represents deviations of the test surface 14 from a theoretical cylindrical surface" (col. 5, lines 25-28, emphasis added). It is this "theoretical cylindrical surface" that is the datum surface for the profiling.

The location of this datum surface is defined by the optics that direct the measurement and reference wavefronts (e.g., diffractive optics 30 and 40, and image-forming optic 42). Such

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optics define a theoretical measurement object surface that would reflect the measurement wavefront to identically match the reference wavefront and produce a uniform interference pattern. Notably, the position of this theoretical surface is independent of any change in the actual position of test surface 14 introduced by air bearing 16.

Therefore, the cited section of Kulawiec does not even describe profiling two surfaces of a test object with respect to different datum surfaces, let alone "determining a spatial relationship between the first and second datum surfaces based on at least one interferometric displacement measurement," as recited in claim 1, or the similar features in claims 42 and 67. Accordingly, we ask the Examiner to withdraw the rejections of claims 1, 42, and 67 as presently amended.

Second, with respect to independent claim 25, we submit that Kulawiec does not teach or suggest "the first and second surfaces of the initialization artifact are the front and back of a common interface," as recited in the claim. Indeed, in making the rejection that the Examiner has failed to point to any initialization artifact in any of the cited references, let alone one in which the front and back of a common interface are used to "calculat[e] an initial spatial relationship between the first and second datum surfaces," as claimed. Absent a showing of prior art that specifically shows every element claimed (and in the case of multiple prior art references provides motivation to combine such references), we submit that the Examiner must withdraw the rejection.

Next, with respect to independent claims 66 and 73, we submit that Kulawiec does not teach or suggest "the electronic processor us[ing] at least one value indicative of PCOR dispersion in the interferometric profiling system and the test object to calculate the geometric property," as recited in claim 66, or "determining a spatial relationship between the interferometrically profiled surfaces which accounts for PCOR dispersion," as recited in claim 73.

Applicants' specification provides considerable discussion regarding effects of PCOR (phase change on reflection) dispersion on interferometric profiling measurements (see pages 34-41 of applicants' specification). Applicants' describe the importance of such effects as follows:

The accuracy of such interferometric absolute surface profiling measurements can be improved by accounting for the phase change on reflection (PCOR) and PCOR

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dispersion (i.e., the frequency dependent variations in PCOR) of the surface material of the test part and the optics of the interferometry system. As indicated below, failure to account for PCOR dispersion in scanning interferometric measurements, even for test parts having uniform PCOR dispersion properties, produces an erroneous shift in the distance from the datum surface to the test surface. Moreover, when the PCOR properties of the test surface vary because the test surface includes dissimilar materials, failure to account for PCOR dispersion can introduce errors in the relative heights of different points on the test surface. (Page 34, lines 14-22 of applicants' specification)

In rejecting claims 66 and 73, the Examiner states "the use of multiple datum positions is for reducing systematic errors, which one skilled in the art would recognize that PCOR is a type of systematic error, or error that is caused by an artifact of the measurement system" (page 6 of Action).

The Examiner provides absolutely no basis for this position. To the contrary, he points to no reference that even describes PCOR, let alone PCOR dispersion. He fails to provide any substance as to why one would "recognize that PCOR is a type of systematic error," especially where Kulawiec itself says very little about what systematic errors he is referring to. He fails to indicate how, if at all, movement of the test piece in Kulawiec can even account for PCOR dispersion. Finally, the Examiner fails to point to any prior art reference that even remotely suggests the importance of PCOR dispersion, such as is expansively taught in applicants' specification. Therefore, absent a showing of prior art that specifically shows every element claimed (and in the case of multiple prior art references provides motivation to combine such references), we submit that the Examiner must withdraw the rejection.

The remaining claims are claims 44, 76, and 79, all of which stand rejected in view of Johnson (U.S. 6,392,752).

With respect to claim 44, we submit that Johnson does not teach or suggest that "the first and second surfaces correspond to different sides of the test object," as recited in the claim as presently amended. To the contrary, to the extent Johnson even describes profiling different surfaces, they are surfaces on a common side of the test object (see, e.g., Figs. 1-3 in Johnson). Accordingly, we ask that the rejection of claim 44 be withdrawn.

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With respect to independent claim 76, we submit that Johnson does not teach or suggest that “the first and second datum surfaces are spaced from one another by a distance greater than a profiling range η of an interferometry system used for the interferometric profiling steps,” as recited in the claim. To the contrary, although Johnson contemplates situations where there may be some height variation on surface 106 (e.g., col. 6, lines 11-13), he clearly intends for his device to work for a nominally flat surface, in which case the datum points for the different microlens units must be spaced from one another by a distance less than their respective profiling ranges, otherwise they could not all produce interference fringes.

Furthermore, as presently amended, claim 76 further recites “providing a spatial relationship between the first and second datum surfaces based on at least one interferometric displacement measurement” (emphasis added), a feature we cannot find in Johnson. Accordingly, we ask that the rejection of claim 76 be withdrawn.

Finally, with respect to independent claim 79, we submit that Johnson does not teach or suggest “a scanning interferometer which during operation separates input light into a first wavefront and a second wavefront, directs the first wavefront along a reference path including a partially reflective first surface and a reflective second surface and the second wavefront along a measurement path contacting a measurement object,” as recited in the claim as presently amended.

In rejecting the claim, the Examiner points to BS1 in Johnson as providing the claimed “partially reflective first surface” (Action at page 12). We disagree because the claim requires the partially reflective first surface to be included along the reference path. To clarify this distinction, we amended claim 79 above to further recite that the scanning interferometer “separates input light into a first wavefront and a second wavefront” and that the “partially reflective first surface” is along the reference path along which the first wavefront is directed. Therefore, claim 79 distinguishes Johnson because BS1 cannot both “separate[e] input light into a first wavefront and a second wavefront” and also be the “partially reflective first surface” in the reference path along which the first wavefront is directed. Accordingly, we ask the Examiner to withdraw the rejection of claim 79.

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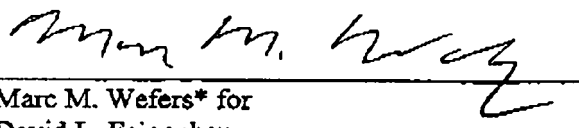
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Having addressed each of the pending independent claims, we submit that each dependent claim is allowable for at least the same reasons as those set forth above for the independent claims.

Enclosed is a check in the amount of \$950.00 for the Petition for Extension of Time fee and a check in the amount of 430.00 for the excess claims fees. Please apply any other charges or credits to deposit account 06-1050, referencing Attorney Docket No. 09712-057001.

Respectfully submitted,

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*See attached document certifying that Marc M. Wefers has limited recognition to practice before the U.S. Patent and Trademark Office under 37 C.F.R. § 10.9(b).

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